A History of Technology Advances Inspired by Disability

**Section 255: Fueling the Creation of New Electronic Curb Cuts**

**By Steve Jacob**

Unusual things happen when products are designed to be accessible by people with disabilities. It wasn't long after sidewalks were redesigned to accommodate wheelchair users that the benefits of curb cuts became apparent to everyone. People pushing strollers, riding on skateboards, using roller-blades, riding bicycles and pushing shopping carts enjoyed the additional benefits of curb cuts! These facts are a prime example of why sidewalks with curb cuts are simply better sidewalks. This same phenomenon occurs when developing telecommunications and computing products and services accessibility in mind. Experts in the telecom access field call it the "electronic curb-cut effect."

Television (TV) manufacturers in the U.S. will tell you that their caption decoders for the deaf wound up benefiting tens-of-millions more consumers than originally intended. As the electronic curb cut effect has shown in the past, televisions with decoders are simply better than those without. For example, captioning can enable TV viewers to:

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| http://www.infinitec.org/images/5x5blue.gif | search for and retrieve video content, by word, through the use of multimedia databases |
| http://www.infinitec.org/images/5x5blue.gif | listen to programs in silence while someone is sleeping |
| http://www.infinitec.org/images/5x5blue.gif | listen to programs in noisy environments like sports bars |
| http://www.infinitec.org/images/5x5blue.gif | watch their favorite program while talking on the telephone, without appearing rude to the person being spoken |
| http://www.infinitec.org/images/5x5blue.gif | to read more effectively, and at an earlier age, it enables children to see the words being spoken at the same time they hear them (i.e. Sesame Street) |
| http://www.infinitec.org/images/5x5blue.gif | learn to read or speak a second language by displaying foreign words at the same time they are being spoken |
| http://www.infinitec.org/images/5x5blue.gif | understand foreign programming through the use of native language captions. |

Following is a list of information technology (IT) innovations, developed by, or in support of, people with disabilities that wound up benefiting everyone. Do any of them strike a familiar note?

**1808:** Pellegrino Turri builds the first typewriter. He built it for his blind friend, Countess Carolina Fantoni da Fivizzono, to help her write legibly.  
[xavier.xu.edu:8000/~polt/tw-history.html](http://xavier.xu.edu:8000/%7Epolt/tw-history.html)

**1872:** Alexander Graham Bell takes up permanent residence in the United States at 35 Newton Street, Boston, where he conducts classes for teachers of the deaf. [www.webbconsult.com/1800.html](http://www.webbconsult.com/1800.html)

**1873:** Herman Hollerith, a young student who experts now recognize as having a cognitive processing disability, begins a habit of jumping from his second story schoolroom window to avoid taking spelling lessons.   
  
**1876:** A patent for the telephone (No. 174,465) is issued to Alexander Graham Bell. The telephone was one of the many devices Bell developed in support of his work with the deaf. [www.webbconsult.com/1800.html](http://www.webbconsult.com/1800.html)  
  
**1886:** Herman Hollerith thought of the idea to use punched cards to keep and transport information, a technology used up to the late 1970s. Those punched cards were read electronically: the cards were transported between brass rods, and when there were holes in the cards, the rods made contact and electric current flow. This device was constructed to allow the 1890 census to be tabulated. This construction meant a great improvement as hand tabulation was projected to take more than a decade. They called this little invention the computer.  
[www-stall.rz.fht-esslingen.de/studentisches/ Computer\_Geschichte/grp2/holler.html](http://www-stall.rz.fht-esslingen.de/studentisches/Computer_Geschichte/grp2/holler.html)   
  
**1896:** Hollerith founds The Tabulating Machine Company.  
[http://www-stall.rz.fht-esslingen.de/studentisches/ Computer\_Geschichte/grp2/holler.html](http://www-stall.rz.fht-esslingen.de/studentisches/%20Computer_Geschichte/grp2/holler.html)

**1916:** Harvey Fletcher joins the Research Division of Bell Labs to work with Irving Crandall on hearing and speech. Fletcher builtthe Western Electric Model 2A hearing aid and a binaural headset in the 1920's and published the widely read book, Speech and Hearing.   
[ac.acusd.edu/History/recording/bell-labs.html](http://ac.acusd.edu/History/recording/bell-labs.html)

**1917:** E.C. Wente of Bell Labs develops the condenser microphone to translate sound waves into electrical waves that could be transmitted by the vacuum tube amplifier.  
[ac.acusd.edu/History/recording/bell-labs.html](http://ac.acusd.edu/History/recording/bell-labs.html)

**1918:** Henry Egerton patents the first balanced-armature driver, based on the 1882 balanced armature telephone patent of Thomas Watson, and used in the Bell Labs. N. H. Ricker develops No. 540AW speakers on October 6, 1922.   
[ac.acusd.edu/History/recording/bell-labs.html](http://ac.acusd.edu/History/recording/bell-labs.html)

**1921:** The amplifier, microphone, and loudspeaker innovations are combined to create the first public address systems. The largest public demonstration of such a system took place on Armistice Day for the national broadcast of the burial of the Unknown Soldier at Arlington Cemetery. The broadcast was heard over 80 loudspeakers linked by telephone lines in New York, San Francisco, and Arlington. By the next year, standardized public-address systems were introduced. [ac.acusd.edu/History/recording/bell-labs.html](http://ac.acusd.edu/History/recording/bell-labs.html)

**1922:** When he turned 70, Bell stated, "Recognition for my work with the deaf has always been more pleasing than the recognition of my work with the telephone." But it was the telephone that transformed America. As a final tribute to Bell, upon his death in 1922 at age 75, the nation's telephones all stopped ringing for one full minute.

**1924:** Twenty-eight years after Hollerith founded the Tabulating Machine Company (1896), it becomes known as International Business Machines (IBM), a name synonymous with computers today. Everybody links IBM with PCs.  
[http://www-stall.rz.fht-esslingen.de/studentisches/   
Computer\_Geschichte/grp2/holler.html](http://www-stall.rz.fht-esslingen.de/studentisches/%20)

**1929:** Harvey Fletcher (see 1916) publishes the widely read book, Speech and Hearing, that analyzed the characteristics of sound. Fletcher led much of the research on binaural "stereophonic" (stereo) sound recording, at Bell Labs.   
[ac.acusd.edu/History/recording/bell-labs.html](http://ac.acusd.edu/History/recording/bell-labs.html)

**1934:** The Readphon is invented--a device that reproduced literature and music on long-playing discs. The Readophone Talking Book was demonstrated to Dr. Herbert Putnam, librarian, and to Dr. H.H. B. Meyer, director, Project, Books for the Blind, Library of Congress, The Readophone disc had two hours and twenty minutes of recording time, the equivalent of 28,000 words. Did you ever play a 33-1/3 rpm record?   
[www.wcblind.org/history.html#top](http://www.wcblind.org/history.html#top)

**1935:** The American Foundation for the Blind publishes the first issue of Talking Book Bulletin. Listened to a book-on-tape lately? [www.wcblind.org/history.html#top](http://www.wcblind.org/history.html#top)

**1936:** Since its earliest days, Bell Labs has been concerned with the properties and analysis of human speech, originally developed to help people who were deaf learn to speak intelligibly. Because of this work, it was inevitable that a Bell Labs scientist would invent an artificial talking machine and, in 1936, H.W. Dudley did. It was the world's first electronic speech synthesizer, and it required an operator with a keyboard and foot pedals to supply "prosody" - -the pitch, timing, and intensity of speech. Dudley called his device the "voice coder" though it simply became known as, "Voder." It was a hit at the New York and San Francisco World's Fairs of 1939.   
[www.research.att.com/history/36speech.html](http://www.research.att.com/history/36speech.html)

**1948:** National Bureau of Standards develops specifications for a low-cost reliable talking-book machine for the blind. Tape recorder anyone?   
[www.wcblind.org/history.html#top](http://www.wcblind.org/history.html#top)

**1948:** In support of the quest to develop more reliable, powerful, flexible, smaller, cheaper, cooler-running, and less power-consuming hearing aids, John Bardeen along with his fellow associates William B. Shockley and Walter H. Brattain, all Bell Labs scientists invented the transistor. This famous invention earned Bardeen and his associates the 1956 Nobel Prize for physics. Sony was not convinced that this was the best use for the transistor and acquired a license for the technology, for $25,000, and invented the transistor radio. Needless to say, this marvelous invention became the primary technology responsible for fueling a revolution in the telecommunications industry that continues today.  
[www.teleport.com/~richards/japanno/part05.html](http://www.teleport.com/%7Erichards/japanno/part05.html)   
and [http://www-users.cs.umn.edu/~dyue/wiihist/japsayno](http://www-users.cs.umn.edu/%7Edyue/wiihist/japsayno)

**1952:** For Bell, whose invention of the telephone created the telecommunications revolution, the original goal of easing the isolation of the deaf remained elusive. His insights into separating the speech signal into different frequency components and rendering those components as visible traces were not successfully implemented until Potter, Kopp, and Green designed the spectrogram and Dreyfus-Graf developed the steno-sonograph in the late 1940s. These devices generated interest in the possibility of automatically recognizing speech (speech recognition) because they made the invariant features of speech visible for all to see. [mitpress.mit.edu/e-books/Hal/chap7.java/seven8.html](http://mitpress.mit.edu/e-books/Hal/chap7.java/seven8.html)

**1952:** As an off-shoot of Bell's work in the deaf community, the first speech recognizer is developed by Davis, Biddulph, and Balashek of Bell Labs. With training, it was reported, the machine achieved 97 percent accuracy on the spoken forms of ten digits. [mitpress.mit.edu/e-books/Hal/chap7.java/seven8.html](http://mitpress.mit.edu/e-books/Hal/chap7.java/seven8.html)

**1960:** Pilgrim Imaging started open captioning for the deaf, for the Captioned Films for the Deaf Program, under the Dept. of Health, Education & Welfare.   
[www.robson.org/gary/writing/jcr-fcc.html](http://www.robson.org/gary/writing/jcr-fcc.html)  
  
**1964:** This year was the turning point when deaf orthodontist, Dr. James C. Marsters of Pasadena, California shipped a teletype machine to deaf scientist, Robert Weitchrecht in Redwood City, California and requested a way to attach it to the telephone system so that telephone communication could take place. Who would have guessed that in 1998 over 100 million people, in all parts of the world, would be communicating with each other, over the Internet, using basically the same technology. Instead of calling our devices Telecommunication Devices for the Deaf (TDDs) or (TTYs), we call them Internet chat rooms!  
[www.deafexpo.org/tty\_museum-history.htm](http://www.deafexpo.org/tty_museum-history.htm)

**1972:** The first nationally broadcast open-captioned program was WGBH's The French Chef with Julia Child, which aired on PBS on August 5, 1972.   
[www.robson.org/gary/writing/jcr-fcc.html](http://www.robson.org/gary/writing/jcr-fcc.html)

**1972:** Vinton Cerf develops the host level protocols for the ARPANET. ARPANET was the first large-scale packet network. Cerf, hard-of-hearing since birth, married a lady who was deaf. Cerf communicated with his wife via text messaging. According to Cerf, "I have spent, as you can imagine, a fair chunk of my time trying to persuade people with hearing impairments to make use of electronic mail because I found it so powerful myself." Had it not been for this experience Cerf may not have used text-messaging to the extent that he did and may not have integrated e-mail as part of the functionality of ARPANET, the precursor to the Internet.  
[www.charweb.org/webinfo/cerf.html](http://www.charweb.org/webinfo/cerf.html)

**1975:** Charge coupled device (CCD) flatbed scanners, which are ubiquitous today, did not exist back in the early 1970s when Ray Kurzweil and his team at Kurzweil Computer Products created the Kurzweil Reading Machine and the first omni-font optical character recognition (OCR) technology. The Kurzweil team created its own scanner using the first CCD integrated chips, a 500 sensor linear array from Fairchild. They did this work in support of the blind.  
[www.kurzweiltech.com/techfirsts/techfirsts.htm](http://www.kurzweiltech.com/techfirsts/techfirsts.htm)

**1976:** Radio Reading Services begins at Minnesota State Services for the Blind. [www.wcblind.org/history.html#top](http://www.wcblind.org/history.html#top)

**1980:** Voice indexing is used for the first time in the talking book, Access to National Parks: A Guide for Handicapped Visitors by the Library of Congress. This technology enables the listener of an audiotape to access the book section using an index to navigate!  
[www.wcblind.org/history.html#top](http://www.wcblind.org/history.html#top)

**1984:** Ray Kurzweil develops the first music keyboard with accoustic sound. The inspiration came in part from a conversation he had with Stevie Wonder, who had been using the Kurzweil Reading Machine for the Blind. [www.kurzweiltech.com/techfirsts/techfirsts.htm](http://www.kurzweiltech.com/techfirsts/techfirsts.htm)

**1988:** Retail point-of-sale (POS) devices began to use picture-based keyboards (mostly fast-food restaurants). This technology was originally developed in the mid 1960's to enable people who were unable to speak to use a keyboard, computer and speech synthesizer to speak. Today, picture-based keyboards enable retail establishments to employ individuals who, for one reason or another, were unemployable 10 years ago.

**1990:** The Americans with Disabilities Act mandates that all telephones required to be accessible, must be equipped with a volume control and/or a shelf and outlets to accommodate telecommunication devices for the deaf (TDDs). This includes a phone jack and a power plug. Cranking up the volume on an accessible telephone makes it usable for everyone in a noisy environment. Have you ever used, or seen someone use, an accessible public telephone to connect up their laptop and retrieve e-mail messages? Another benefit of the ADA is the lowering of pay telephones so that wheelchair users can access them. Because of this mandate, children can also access these same telephones. They can even reach and read the phone books! Wouldn't it be great if all public telephones were accessible? [www.trace.wisc.edu/docs/adaag\_only/adaag.htm#4.1.3(17)(c)](http://www.trace.wisc.edu/docs/adaag_only/adaag.htm#4.1.3(17)(c))

**1994:** National Federation of the Blind establishes dial-up synthetic-speech talking newspaper, making a daily newspaper available to blind people by 6:30 a.m. on day of issue for the first time. Anyone interested in listening to your favorite newspaper? [www.wcblind.org/history.html#top](http://www.wcblind.org/history.html#top)  
  
**Mid-1990's:** Many new products come on the scene: For people with limited mobility, voice-activated telephones, lamps and switches. For people who are blind, talking caller IDs, pagers, telephone keypads with large buttons, alarm clocks, calculators, watches and variable-speed/pitch tape recorders.. For people who are hard-of-hearing, telephones with volume control.

**1996:** Productivity Works develops, pwWebSpeak, a browser that translates information content from Web pages into speech. This great new technology can provide web access to anyone in eyes busy-environments (like driving a car, though I don't recommend this particular use!) [www.prodworks.com/pwwebspeak/index.htm](http://www.prodworks.com/pwwebspeak/index.htm)

**1997:** NCR Corporation develops the world's first Audio ATM designed to provide accessible banking for blind and partially sighted people. According to Rick Makos, Vice President of NCR Canada's Financial Solutions Group, "technology is the great equalizer." The Audio ABM can potentially grant access to more than 50 million people around the world who are blind or visually impaired, as well as the 1.4 billion people who can neither read nor write.  
<http://www3.ncr.com/press_release/pr111297b.html>  
<http://www3.ncr.com/press_release/pr082698.html>

**1998:** Nokia releases LPS-1 Loopset. Hearing aid users have new found mobile freedomwith this new device. Based on induction technology, the Loopset allows hearing aid users to talk on digital mobile telephones. It has a built-in microphone for hands-free operation, and is compatible with Nokia 5100 series and Nokia 6100 series mobile telephones, which have an automatic answer function that works with the Nokia Loopset. By the way, people who are not hard-of-hearing or deaf can use this Loopset for hands-free operation of their cellular telephone. One extra hand on the wheel means added safety for both the driver and those around them!   
[http://www.nokiausa.com](http://www.nokiaaccessibility.com/accessories.html)

**1998:** Productivity Works launches another voice-based browsing product, that utilizes the telephone. The firm's pwTelephone is geared not only to visually impaired users, but also to people without access to Internet-ready PCs. The software may also prove useful to firms that want to provide information, such as schedules or price lists, both by telephone and over the Internet, and from a single source. [www.prodworks.com](http://www.prodworks.com)

**1999:** The World Wide Web Consortium (W3C) releases their Web Content Accessibility Guidelines specification =A7. Using this specification, Web content developers can develop Web pages that not only meet their sales, marketing and information objectives, but Web pages which can be accessed by a standard telephone (no computer). With =A7, anyone could use a pay telephone to access, navigate, and retrieve information from Web pages and are less costly to translate into foreign languages (see Productivity Works, 1996). Developing accessibility for people with cognitive disabilities stresses the simplification of words, and the elimination of extraneous words, from Web pages. This can benefit all Web users. =A7 can be accessed by lower-powered PCs and from within narrower bandwidth information infrastructures. These specifications demonstrate how to develop graphical Web pages that have the ability to present their full message with the browser's graphics display turned off. This programming technique enables a company to free up bandwidth at critical times without impacting their Intranet sites.  
<http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505>

**About the Association of Access Engineering Specialists (AAES)**  
AAES is a professional organization concerned with improving access to telecommunications and computing products and services for millions of people with disabilities.

The primary purpose of AAES is the development of the field of access engineering. AAES actively seeks to refine a technical consensus among all parties affected by telecommunications and other electronic and information technology access. To this end AAES will initiate, foster, and promote dialog between the disability community and industry involving accessibility issues. AAES was formed as a specialist group under The National Association of Radio and Telecommunications Engineers (NARTE) <http://www.narte.org> and in partnership with, The Rehabilitation Engineering and Assistive Technology Society of North America (RESNA), <http://www.resna.org>, in 1997.

AAES emerged from the collaborative work of the Telecommunications Access Advisory Committee (TAAC), <http://www.access-board.gov>that was formed to assist the U.S. Access Board at <http://www.access-board.gov> in fulfilling its mandate to issue accessibility guidelines under Section 255 of the Telecommunications Act of 1996.

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